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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
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Washington, D.C. 20231
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in its capacity as elected Office

Date of mailing (day/month/year)

27 September 2000 (27.09.00)

International application No.

PCT/GB00/00472

Applicant's or agent's file reference

International filing date (day/month/year)

14 February 2000 (14.02.00)

Priority date (day/month/year)

12 February 1999 (12.02.99)

Applicant

COGLEY, Kevin et al

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

19 August 2000 (19.08.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Zakaria EL KHODARY

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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REC'D 17 NOV 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)


Applicant's or agent's file reference ./.		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
FOR FURTHER ACTION			
International application No. PCT/GB00/00472	International filing date (day/month/year) 14/02/2000	Priority date (day/month/year) 12/02/1999	
International Patent Classification (IPC) or national classification and IPC B21J15/32			
Applicant HENROB LIMITED et al.			

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 7 sheets, including this cover sheet.
 - ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 19/08/2000	Date of completion of this report 15.11.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Ritter, F Telephone No. +49 89 2399 2387



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00472

1. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

1-8 as originally filed

Claims, No.:

1-8 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00472

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 2,9.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 2,9 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination report cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Yes: Claims 1,3-8

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/00472

	No:	Claims	
Inventive step (IS)	Yes:	Claims	1,3-8
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1,3-8
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00472

Re Item III

The subject-matters of dependent claim 2 and independent claim 9 are so unclear (Article 6 PCT) that no examination can be carried out.

Claim 2 depends on apparatus claim 1, but does not contain any additional feature of the apparatus. The pressure of 2 bar or less is a result achieved by a feature of claim 1, the sealable passage.

Independent claim 9 refers back to the accompanying drawings. Since it is not perceivable, which features shown in the drawings form part of the invention, no meaningful opinion concerning novelty or inventive step can be given.

Re Item V

1. Reference is made to the following document:

D1: US-A-3 466 730

2. Independent claim 1:

The subject-matter of claim 1 is unclear according to Article 6 PCT. Due to the expression "the delivery tube is connected between a supply of fasteners and a setting tool of a fastener machine", the impression is given, that the setting tool would also form part of the delivery apparatus. But since the delivery apparatus only comprises the supply of fasteners, the delivery tube and the source of pressurized gas, the analysis is based on the following wording of claim 1:

"Fastener delivery apparatus comprising a fastener delivery tube connected to a supply of fasteners and being connectable to a setting tool of a fastener machine, ..."

Document D1, which is considered to represent the closest prior art, discloses:

Fastener delivery apparatus (figures 11, 12) comprising a fastener delivery tube (44) connected to a supply of fasteners (134) and being connectable to a setting tool of a fastener machine, the tube (44) being connected to a source of pressurized gas (188), and the supply of fasteners (134) being

connected to the delivery tube (44) via a sealable passage (168) that may be sealed so as to prevent leakage of gas from the delivery tube (fig. 11).

The subject-matter of claim 1 differs from D1 by:

the tube being of a cross-section having an internal cross-section configured to conform substantially to the size and shape of the fastener to be used and by the source of pressurised gas having a supply bore with an interior shape and dimension that is substantially equal to the interior dimension and shape of the delivery tube.

The technical effect achieved by the matching size and shape of the gas outlet bore and the delivery tube is a reduction in turbulence of the pressurised gas, thereby ensuring a smooth and laminar flow of gas and preventing the fasteners from being thrown against the walls of the delivery tube and losing momentum as they travel along the tube. The problem solved consists in the possibility to transport the fasteners through very long delivery tubes.

None of the prior art documents gives a lead to perform the combination of features according to claim 1.

The subject-matter of the clarified claim 1 is considered to be new and inventive (Article 33(2) and 33(3) PCT).

3. Dependent claims 3 to 8:

Since dependent claims 3 to 8 show further embodiments of the apparatus according to claim 1, their subject-matters are also considered to be new and inventive (Article 33(2) and 33(3) PCT).

Re Item VII

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00472

in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII

See Item III and Item V, section 2..

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FASTENER DELIVERY APPARATUS

The present invention relates to fastener delivery apparatus and more particularly, but not exclusively to delivery apparatus for transferring rivets from a supply to a setting tool of a riveting machine.

The term "fastener" is used herein to describe rivets, screws, slugs or other types of fastening devices.

It is well known to distribute rivets or other fasteners (e.g. studs, nuts, bolts) between a supply and a setting tool of a riveting machine or setting tooling within a press by conveying them individually in delivery tubes by compressed air propulsion. A delivery tube of this kind typically has an internal passageway that is configured to conform closely to the shape of the fastener. Additional compressed air may be admitted into the tube at one or more locations along the length of the tube by means, for example, of T-junctions, branch tubes, or elbows connected between a supply of compressed air and the delivery tube, to propel the rivets along the length of the tube.

There are several problems associated with compressed air delivery tubes of the kind described above. First, there is a tendency for fasteners to jam in the tube. This renders the tube inoperable until steps have been taken to clear the blockage. It is often desirable to be able to transport a plurality of fasteners at once along a delivery tube but this significantly increases the tendency to jam. Secondly friction between the fasteners and the tubes causes tube wear. Delivery tubes have to be inspected at regular intervals for wear as a worn tube may be susceptible to blockages or slower feed rates causing increased cycle times. Moreover, wear often results in accumulation in the delivery tube of external dirt, dust or moisture or trace particles of the fastener, fastener coating or tube and they may also cause blockages and slower feed rates.

Compressed air pressure normally decreases along the length of the delivery tube owing to losses (such as for example leaks or friction losses). The desired pressure is generally maintained by supplying further air at booster points (in the form of T-junctions and branch tubes etc.) along the length of the tube and/or by increasing the pressure of the compressed air at source. The increase in air pressure and the

addition of booster points increases air turbulence within the tube. If the flow of air is not as smooth as possible there is an increased tendency for fastener jams and the resultant scraping contact can in turn cause wear in the tube. The decreasing air-pressure owing to losses can also cause heavier fasteners to lose momentum so that they fail to reach the end of their journey with sufficient speed unless compressed air booster points are employed.

Existing delivery tubes are often lubricated to ensure that fasteners are transferred at acceptable speeds, and to reduce wear and friction. However, over a period of use the ingress of dirt can result in the tube becoming clogged by a paste comprising the combination of the dirt or trace particles and lubrication oil or moisture.

Known compressed air fastener delivery systems operate at an air pressure of between 5 and 6 bar. This pressure is normally required to ensure sufficient fastener momentum throughout the length of the delivery tube so that it reaches the desired destination despite friction losses or minor obstacles (dirt etc) in the tube, and/or to accommodate air loss through leakages. A further disadvantage is that known systems may require the continuous application of such air pressure at 5-6 bar to maintain effective performance, as opposed to controlled blasts. Moreover, owing to the above limitations, known systems cannot reliably feed fasteners over long distances, the maximum possible tube lengths being typically 8m-15m.

It is an object of the present invention to obviate or mitigate the aforesaid disadvantages and to provide for fastener delivery apparatus that operates at higher transportation speeds, greater distances (typically in excess of 100m) and lower air pressures (and therefore lower air consumption rate and cost) than currently possible without the use of a lubricant.

According to the present invention there is provided a fastener delivery apparatus comprising a fastener delivery tube connected between a supply of fasteners and a setting tool of a fastener machine, the tube having an internal cross-section configured to conform substantially to the size and shape of the fastener to be used and connected to a source of pressurised gas, wherein the source of pressurised gas

has a supply bore with an interior shape and dimension that is substantially equal to an interior dimension and shape of the delivery tube and wherein the supply of fasteners is connected to the delivery tube via a sealable passage that may be sealed so as to prevent leakage of gas from the delivery tube.

By ensuring that the size and shape of the pressurised gas outlet bore and the delivery tube are matched, there is a significant reduction in turbulence of the pressurised gas. This ensures that the flow of gas remains smooth and laminar thereby preventing fasteners from being thrown against walls of the delivery tube and losing momentum as they travel along the tube. Lubrication of the tube is therefore not required and feeding of a plurality of rivets at once becomes feasible. In addition, the sealed passage reduces the leakage of gas from the apparatus. This feature enables the compressed gas to be supplied at significantly lower pressures, such as 2 bar or less, than is currently possible. The profile of the fastener in the tube provides an effective seal and the smooth laminar flow of the gas reduces its contact with the wall of the delivery tube. In reducing the gas pressure required to transport the rivet the running cost of the apparatus is significantly reduced. Moreover, noise pollution is significantly reduced. The use of a sealed passage provides a barrier against the ingress of dirt and ensures that the pressurised gas supply is used efficiently by directing all of the supplied gas towards the fastener.

Such apparatus also achieves consistent, repeatable minimum transport times for each given design of fastener allowing the full process cycle, e.g. feeding and riveting, to be efficiently implemented at as high a rate as possible.

The present invention lies partly in the realisation that the flow rate of the pressurised gas is more important than the gas pressure in transporting fasteners and that it is more efficient to introduce a fastener into the path of a pressurised gas jet rather than to direct the gas towards the fastener in the tube via branch tubes or the like.

The pressure of the pressurised gas is preferably 2 bar or less.

The source of pressurised gas is preferably disposed so that, in use, gas is in coaxial with a longitudinal axis of the tube.

Preferably the sealable passage is sealable by a gate having an internal cross-section that is substantially matched in terms of shape and dimension to the internal cross-section of the delivery tube so as to reduce turbulence or drag to the flow of gas passing it.

The passage is preferably sealed by a transfer gate preferably in the form of a ball valve that is rotatable between a first position in which an aperture in the ball valve is in communication with the supply of fasteners so as to receive at least one fastener and a second position in which the aperture provides a path between the source of pressurised gas and the delivery tube.

Advantageously the delivery tube is of a size such that, in use, there is clearance between the fastener and the tube so as to provide a gas cushion around the fastener. This reduces the friction between the fastener and walls of the delivery tube and also reduces the tendency of the fastener to jam in the tube. These advantages outweigh any reduction of motive force due to air leakage past the fastener.

Specific embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of fastener delivery apparatus of the present invention;

Figures 2a to 2c show the operation of a fastener transfer gate in transferring a fastener from a supply into a delivery tube;

Figure 3 shows a rivet in a delivery tube of the present invention; and

Figure 4 is a cross-section through a modified embodiment of a fastener transfer gate.

Referring now to the figure 1 of drawings, there is shown apparatus for transferring rivets from a central rivet supply to the nose of a rivet setting machine (neither of which are shown in the drawings).

The apparatus comprises a rivet delivery tube 1 in which rivets 2 are transported individually or in groups between the supply and the nose of the rivet setting machine, a compressed air supply 3 connected to one end of the delivery tube 1 and a rivet transfer gate assembly 4 disposed in close proximity to the compressed

air supply 3. The transfer gate assembly 4 comprises a housing 5 with a first inlet aperture 6 connected to an outlet tube 7 of the compressed air supply 3, a second inlet aperture 8 connected to the end of a feeder tube 9 from the rivet supply and an outlet aperture 10 connected to the delivery tube 1.

The interior of the housing 11, shown in figures 2a to 2c, has a tube portion interconnecting the delivery tube 1 and the outlet tube 7 of the compressed air supply 3. The tube portion incorporates a ball valve assembly 12 comprising a valve seat 13 in which there is disposed a rotatable ball valve 14. The valve seat 13 includes O-ring seals 15 or the like disposed on each side of the ball valve 14.

The ball valve 14 has a central passage 16 and is rotatable, by means of a rotary actuator 17, between a first position in which it is coaxially aligned with the feeder tube 9 and a second position in which it is coaxially aligned with the outlet tube 7 of the compressor supply 3 and the delivery tube 1. In the first position of the ball valve 14 (shown in figure 2a) the rivet 2 is able to enter the ball valve passage 16 of the transfer gate assembly 5 from the feeder tube 9. Rotation of the valve 14 to the second position (shown in figures 2b and 2c) moves the rivet 2 through 90° and seals the feeder tube 9 against communication with the compressed air supply 3. This ensures that the full force of the compressed air (now in communication with the passage 16 in the ball valve 14) is used to propel the rivet 2 into the delivery tube 1 as represented by the arrows in figure 2c.

The apparatus is designed such that there is an annular clearance 18 (shown in figure 3) between the head of the rivet 2 and the walls of the delivery tube 1. This enables some of the compressed air to pass through the clearance 18 and provides an air cushion between the rivet 2 and the tube 1 to reduce the frictional contact therebetween.

The source of compressed air is disposed so that the path of the air is substantially co-axial with the longitudinal axis of the delivery tube so as to minimise turbulence.

The high flow-rate but low pressure of the air ensures that effective use is made of the air for transporting the rivet.

The cross-section of the bore of the compressed air supply outlet tube 7 is designed to match the size and shape of the interior passage of the delivery tube 1 and the ball valve 14. This ensures that the flow of compressed air is smooth and laminar thereby preventing rivets from being thrown against walls of the delivery tube 1 and losing momentum as they travel along the tube 1. Moreover the internal cross section of the ball valve passage 16 is matched in terms of size and shape to the internal cross-section of the delivery tube for the same reasons.

When the ball valve 14 is rotated to allow the rivet 2 to be blown into the delivery tube 1, it serves to seal the feeder tube 9 from the compressed air supply 3 and thus reduces the leakage of air from the apparatus. This feature enables the compressed air to be supplied at significantly lower pressures, such as 2 bar or less, than those that are currently used. The profile of the rivet 2 in the delivery tube 1 provides an effective seal and the smooth laminar flow of the air reduces its contact with wall of the delivery tube 1. In reducing the air pressure required to transport the rivet 2 the cost of the apparatus is significantly reduced. Moreover, noise pollution is significantly reduced.

Figure 4 shows a more detailed embodiment of the transfer gate. The ball valve 14 is mounted in a valve seat 20 defined by a housing body 21 so that it is rotatable in the manner described above. The delivery tube 1, the air supply outlet tube 7 and the fastener feeder tube 9 are all of identical or similar configuration and their ends connect to the transfer gate housing body 21 via interface collars 22a, 22b, 22c which are all of identical design. The interface collars 22a, 22b, 22c are designed to mate with complementary formations on the housing body 21 and, once connected, are sealed thereto by seals 23. Each end of the delivery, air supply outlet and feeder tubes 1, 7, 9 has an annular radially outward extending flange 24a, 24b, 24c that is received inside the respective collar 22a, 22b, 22c with an axial clearance 25. Springs 26 are disposed parallel to the axis of the respective tube 1, 7, 9 between the collar 22a, b, c and the flange 24a, b, c and serve to bias the tubes 1, 7, 9 towards the ball valve 14.

When the passage 16 in the ball valve 14 is coaxial with a particular tube 1, 7, 9 the respective spring 26 biases the tube axially into sealing engagement with the ball valve 14, so that air loss at the junction between the tube 1, 7, 9 and ball valve 14 is significantly reduced or eliminated entirely. The axial clearance enables the tube 1, 7, 9 to deflect axially out of the housing 21 slightly as the ball valve 14 is rotated and comes into contact with it and the springs 26 ensure that the tube 1, 7, 9 move axially back into full sealing engagement when aligned with the ball valve passage 16. Thus the ball valve 14 acts as a cam against the ends of the tubes 1, 7, 9.

The exterior of the tubes 1, 7, 9, and/or collars may be provided with any form of protuberance or other projecting formation that is complementary to a groove or recess in the housing body 21 so as to ensure correct orientation and location of the tube in the housing body. The connection between the tube 1, 7, 9 and housing body 21 is also preferably designed to be a quick-connect coupling, such as, for example, a snap-fit.

In a modified embodiment (not shown) there may be provided an additional source of compressed air or other pressurised gas that is directed over the rivet or rivets in the transfer gate so that the rivet(s) is cleaned of surface dust or debris etc.

The use of a sealed transfer gate provides a barrier against the ingress of dirt and ensures that the compressed air supply is used efficiently by directing all of the supplied air towards the fastener. It also enables a plurality of fasteners to be delivered at once with reduced risk of jamming.

It will be appreciated that numerous modifications to the above described design may be made without departing from the scope of the invention as defined in the appended claims. For example, the transfer gate need not be in the form of a ball valve but may take other forms and may be operated automatically provided that the compressed air supply is sealed from the feeder tube when the rivet is being propelled into and along the delivery tube.

It is to be understood that although the exemplary fastener delivery apparatus has a compressed air supply, and that any suitable supply of pressurised gas can be used. Moreover, although the rivet is shown in figure 3 as being transported axially,

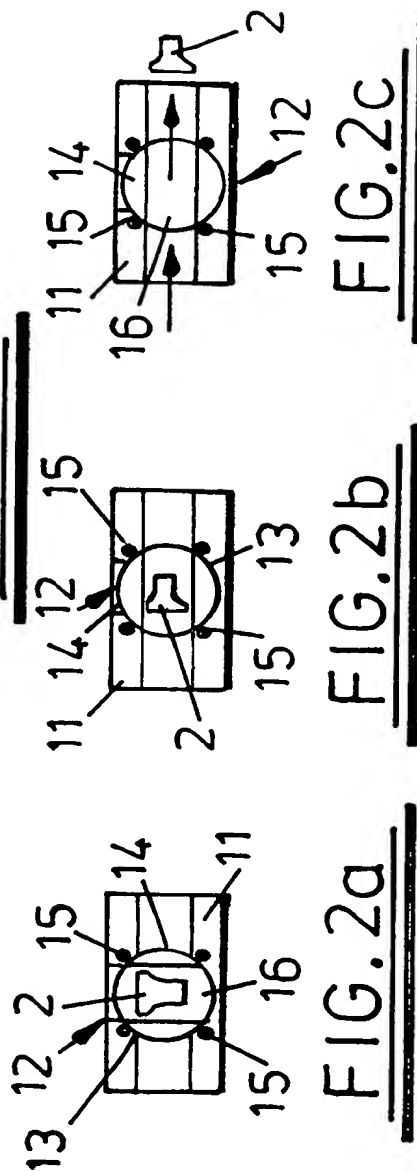
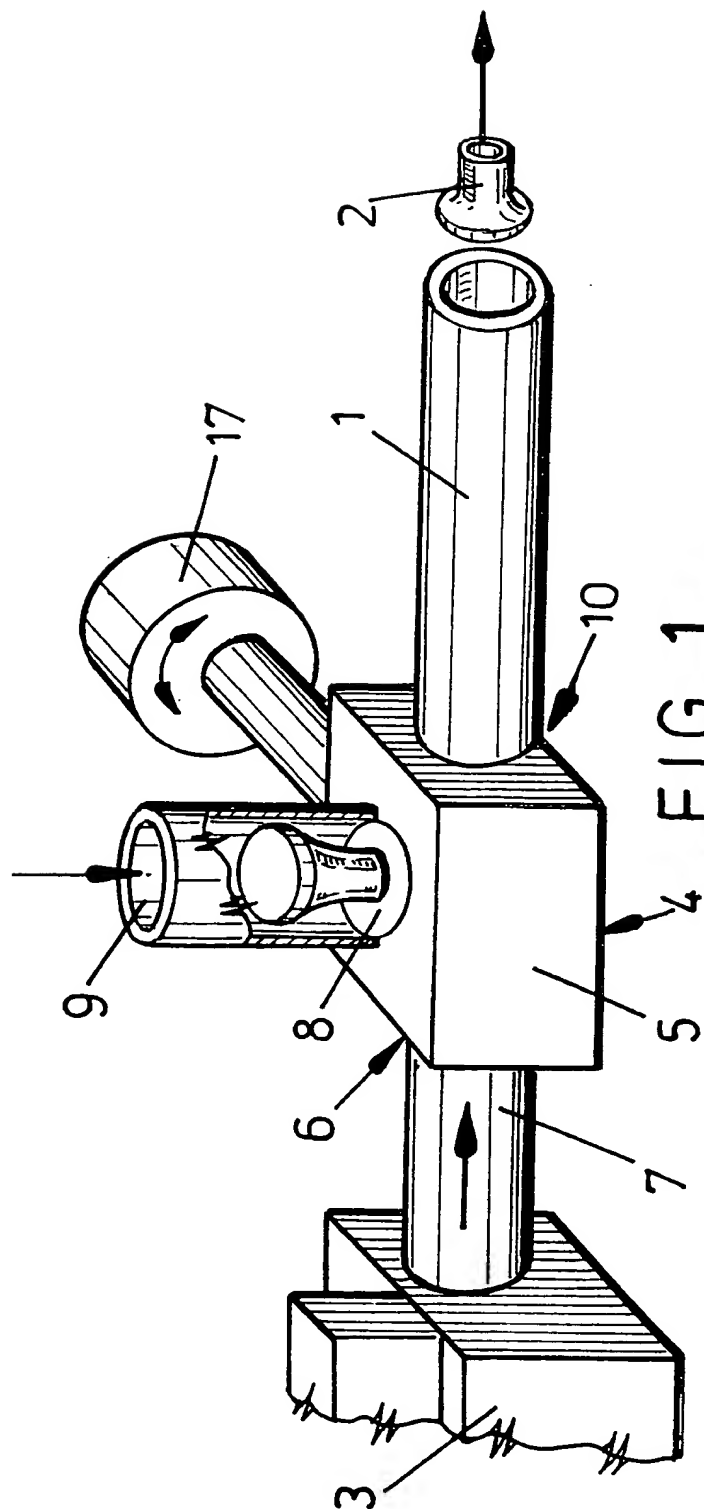
the principles described above apply equally to a rivet that it transported sideways through a tube having an internal profile that is T-shaped.

CLAIMS

1. Fastener delivery apparatus comprising a fastener delivery tube connected between a supply of fasteners and a setting tool of a fastener machine, the tube being of a cross-section having an internal cross-section configured to conform substantially to the size and shape of the fastener to be used and connected to a source of pressurised gas, wherein the source of pressurised gas has a supply bore with an interior shape and dimension that is substantially equal to an interior dimension and shape of the delivery tube and wherein the supply of fasteners is connected to the delivery tube via a sealable passage that may be sealed so as to prevent leakage of gas from the delivery tube.
2. Fastener delivery apparatus according to claim 1, wherein the pressure of the pressurised gas is 2 bar or less.
3. Fastener delivery apparatus according to claim 1 or 2, wherein source of pressurised gas is disposed so that, in use, the path of the gas is coaxial with a longitudinal axis of the tube.
4. Fastener delivery apparatus according to claim 1, 2 or 3 wherein the sealable passage is sealable by a gate having an internal cross-section that is substantially matched in terms of shape and dimension to the internal cross-section of the delivery tube so as to reduce turbulence or drag to the flow of gas passing it.

5. Fastener delivery apparatus according to any preceding claim, wherein the sealable passage is in the form of a ball valve that is rotatable between a first position in which an aperture in the valve is in communication with the supply of fasteners so as to receive at least one fastener and a second position in which the aperture provides communication between the source of pressurised gas and the delivery tube.
6. Fastener delivery apparatus according to any preceding claim, wherein the delivery tube is of a size such that, in use, there is a clearance between the fastener and the tube so as to provide a gas cushion around the fastener.
7. Fastener delivery apparatus according to any preceding claim wherein the delivery tube has external orientation and/or location features.
8. Fastener delivery apparatus according to any preceding claim wherein there is provided an additional source of pressurised gas in the sealable passage that serves to clean the rivets of dirt or debris.
9. Fastener delivery apparatus substantially as hereinbefore described with reference to the accompanying drawings.

1/2



2/2

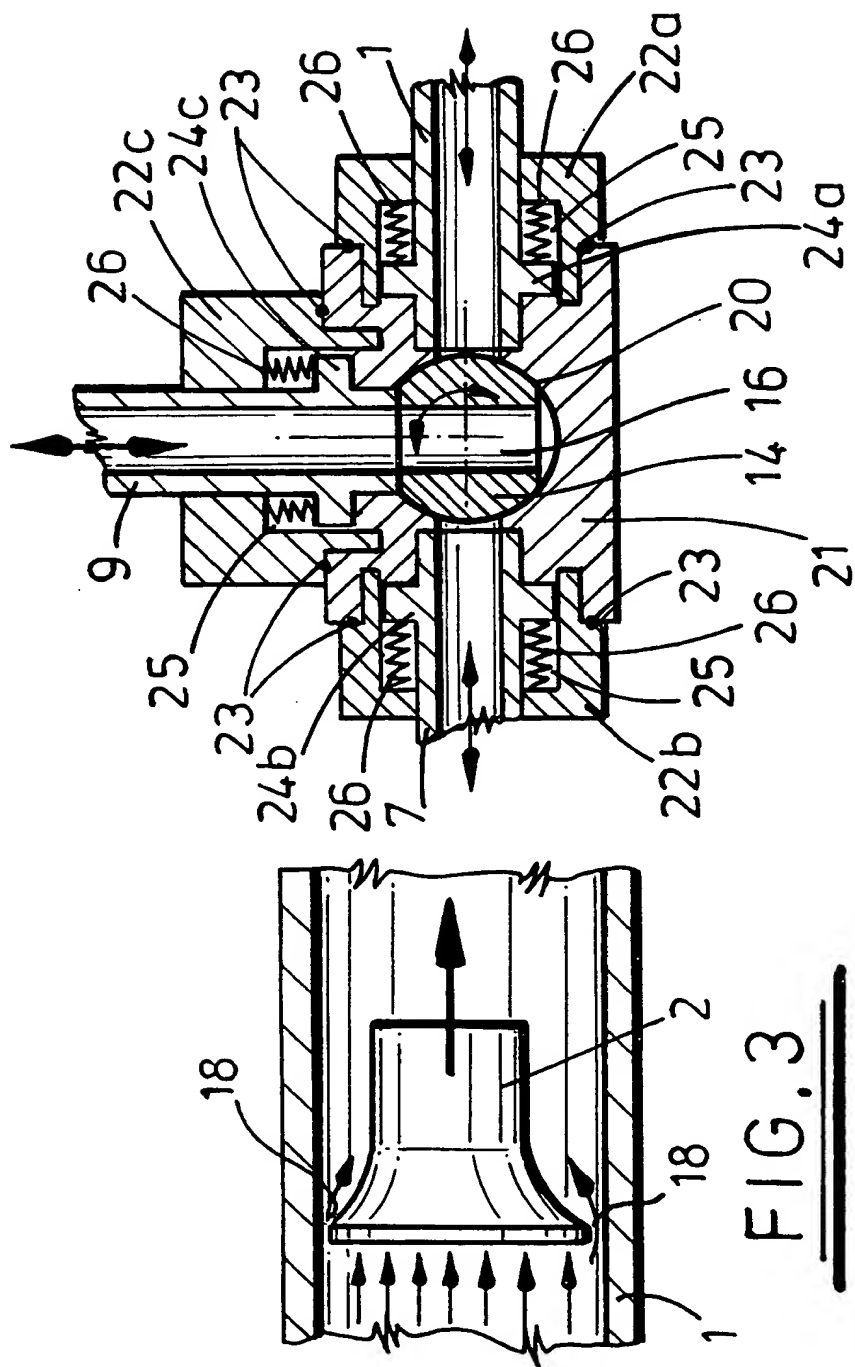


FIG. 4

FIG. 3

INTERNATIONAL SEARCH REPORT

Internat Application No

PCT/GB 00/00472

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B21J15/32 B23P19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B21J B23P B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 487 190 A (GLORIOSO PAUL A ET AL) 30 December 1969 (1969-12-30) column 3, line 22 - line 38; figure 1	1,3,4,7, 9
A	US 3 466 730 A (MCENRY KENNETH A ET AL) 16 September 1969 (1969-09-16) column 3, line 14 - line 21; figures 11,12	1,5
A	US 2 993 737 A (WESTERN ELECTRIC COMPANY) 25 July 1961 (1961-07-25) column 2, line 49 - line 66; figures 2-4	1,6

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

11 April 2000

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Marc Augé

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 00/00472

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3487190	A	30-12-1969	DE 1615170 A	16-04-1970
US 3466730	A	16-09-1969	DE 1527530 A	16-07-1970
			DE 1777275 A	04-11-1971
US 2993737	A	25-07-1961	NONE	